

Five new species of *Metapolybia* Ducke, 1905, with the description of the male genitalia of seven species of the genus (Hymenoptera, Vespidae, Polistinae)

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Abstract

Five new species of *Metapolybia* are described, *Metapolybia carpenteriana*, Andena & Noll, **sp. nov.** (Ecuador, Peru), *Metapolybia pseudodocilis* Cortes, **sp. nov.** (Bolivia), *Metapolybia richardsi* Andena, **sp. nov.** (Ecuador), *Metapolybia sulamerica* Carpenter, **sp. nov.** (Colombia), *Metapolybia zucchini* Andena & Carpenter, **sp. nov.** (Panama), in addition to the hitherto unknown males of *M. bromelicola*, *M. encantata*, *M. mesoamerica*, *M. servilis* and *M. rufata* plus two new species. Comparative remarks for the species are given.

Keywords

Epiponini, Paper wasps, Social wasps

Introduction

Metapolybia Ducke is an epiponine genus with eighteen species described, strictly neotropical, extending from Mexico to the middle-southern part of Brazil and Paraguay, with most species found in the Amazon (Richards 1978; Cooper 1999; Andena and Carpenter 2011; Somavilla and Andena 2018; Andena et al. 2019).

Some species of *Metapolybia* have been studied in detail concerning behavior (West-Eberhard 1978; Karsai and Wenzel 2000; Baio et al. 2003; Chavarría and Noll 2013). The castes are hardly detectable by external morphology (Richards 1978; Carpenter and Ross 1984). Baio et al. (2003), studying *M. docilis*, found slight differentiation between queens and workers, at least in the early stages of nest development. In *M. aztecoides* it was found that castes are apparently determined by disputes among adults rather than by larval manipulation (West-Eberhard 1978, 2000). This process was later confirmed not only for the genus, but for the whole tribe (Chavarría-Pizzaro et al. 2023).

Richards (1978) considered the nest of *Metapolybia* as astelocyttarus, usually on a tree-trunk where the flat envelope is made of local material, often highly cryptic, but also on buildings where they may be relatively conspicuous. The nest is characterized by a single comb expanded suddenly in blocks, with new cells built on the substrate adjacent to earlier ones and on any side of them when the nest is on a horizontal surface, growing upwards on vertical surfaces and around curved surfaces (Wenzel 1998). The envelope is built up from the substrate or from fully elongated cell walls (*M. docilis*), with a single sheet and secretion forming clear windows; the entrance is peripheral and curved upward (Richards 1978; Wenzel 1998); however, two species lack an envelope (*M. bromelicola* and *M. encantata*).

According to Richards (1978) the genus is characterized by the absence of a pronotal keel or fovea; the entrance to the spiracular chamber high and very narrow; the occiput somewhat emarginate with the head produced behind the eyes; the gena not margined; the metasomal petiole long and narrow, being widened and convex at its posterior end. The species “*Metapolybia alfkenii*” once cited in a list of species recorded to Brazil (Barbosa et al. 2016), is, in fact, an erroneous contraction of *Mischocyttarus alfkenii* (Ducke 1904). Since the last revision (Richards 1978), seven species were described: *Metapolybia mesoamerica* Smethurst & Carpenter, 1998, *M. encantata* Cooper, 1999, *M. silvicola* Cooper, 1999, *M. servilis* Cooper 1999, *M. miltoni* Andena & Carpenter, 2011, *M. araujoi* Somavilla & Andena, 2018 and, *M. fraudator* Carpenter & Andena, 2019.

Here, we describe five new species of *Metapolybia*. Also, the male genitalia of seven species are depicted and re/described.

Methods

The specimens analyzed were borrowed from the following institutions: **AMNH**—Americam Museum of Natural History, New York, USA; **MPEG**—Museu Paraense Emílio Goeldi, Belém, Brazil; and **NHM**—Natural History Museum, London, UK.

The external morphology of dry pinned adult specimens was observed under the stereo microscope Leica MZ75. Photographs were taken using the stereo microscope Leica M205 C with attached Flexacam C1 camera and LASx software. Male genitalia were extracted, treated in a 10% KOH solution and observed under stereo microscope. Illustrations were produced for each specimen employing the Inkscape v. 1.3 software.

The terminology and standardization follow Richards (1978), Andena and Carpenter (2011), and Somavilla et al. (2018).

Results

Metapolybia carpenteriana Andena & Noll, sp. nov.

<https://zoobank.org/4ABBB23F-BEE8-4133-A843-2D29A13A5A5A>

Figs 1–5

Diagnosis. Very like *M. suffusa* in color and general aspects, but with yellow markings more isolated with only the metasoma being more extensively reddish resembling the *M. suffusa* pattern, the head is more distinctly excavated and emarginated behind, lateral pronotal carina more raised and somewhat sharp, propodeum with fewer and shorter bristles and most of them concentrated on the posterior region, and tergum I more produced after spiracles.

Description. Female. Size: 5.5 mm. Length of fore wing 5.5 mm.

Color: Blackish species with yellow markings as follows: spot in U-shape on clypeus, inner orbits, and bottom of gena; mandibles with a yellow band extending longitudinally; broad band on anterior margin of pronotum, covering the lateral pronotal carina, interrupted medially and posterior margin of pronotum, fading to sides, both connected dorsally forming an X shape; two lateral spots on scutellum, metanotum and bottom of propodeum; axilla yellow; Antennal articles blackish, last three antennomeres brownish/reddish beneath, scape brownish above and yellowish beneath; Fore legs blackish, coxae with yellow spots, tibia and tarsus orange, mid and hind legs blackish, coxae sometimes with yellow spots. Metasoma orange/reddish, yellow bands on tergum and sternum I to V. Body surface covered with yellowish tomentum. Wings hyaline, venation brown.

Head: (1) clypeus 1.8 times wider than longer with punctures shallow, scattered, separated by more than 2.0 diameters; (2) inter-antennal prominence moderately raised, subacute with weak medial furrow; (3) frons and vertex with punctures denser than clypeus, shallow separated by about 1.0–2.0 diameters; (4) gena 0.75–0.8 wider than width of the eyes, slightly narrowing to mandibular condyle, punctures very shallow and scattered; (5) tempora narrowing to vertex; (6) posterior region of the head excavated, moderately emarginated.

Mesosoma: (1) pronotum with very shallow and scattered punctures, lateral pronotal carina raised, subacute to acute; (2) humeri do not at all projected in front of tegula, rounded; (3) pretegular carina acute on upper region, curved, not interrupted; (4) scutum 1.1 times wider than longer with very small and scattered punctures; (5) mesopleura with shallow punctures separated by more than 2.0 diameters, like those on frons and vertex; (6) scutellum very slightly concave, almost flat, with shallow punctures or absent, indistinct, medial line raised anteriorly, weakly marked posteriorly; (7) metanotum slightly concave, slightly pointed posteriorly; (8) metapleuron with scattered punctures, upper plate 1.5 times longer than wide; (9) propodeum, with moderately long and sparse outstanding hairs, predominantly on posterior region; (10) propodeal concavity narrow and moderately deep, developed anteriorly, weakly striate, not extending laterally, scattered punctuation; (11) prestigma as long as wide, tip rounded-truncate.

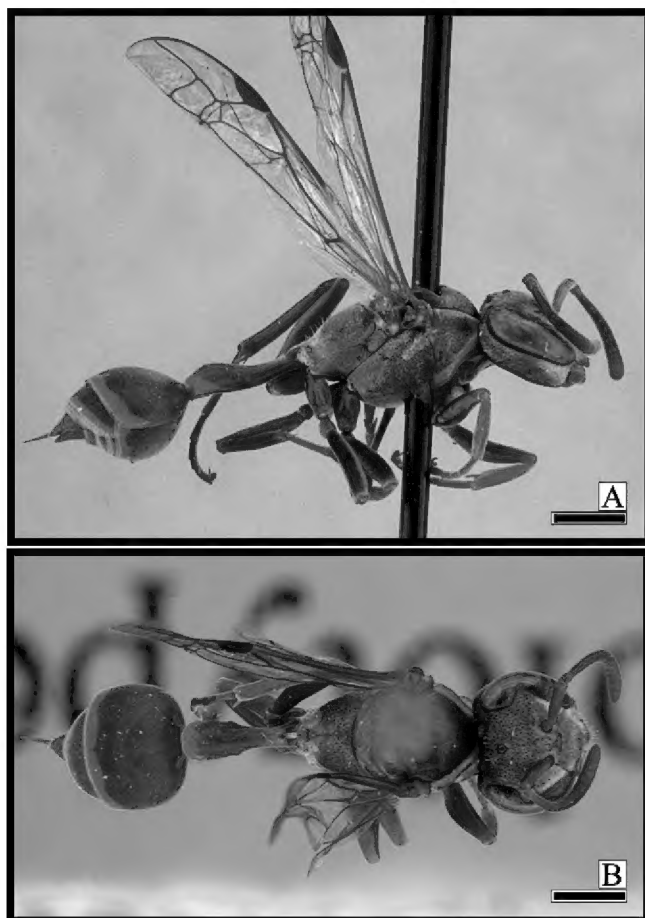


Figure 1. *Metapolybia carpenteriana* **A** lateral view **B** dorsal view. Scale bars: 1.0 mm.

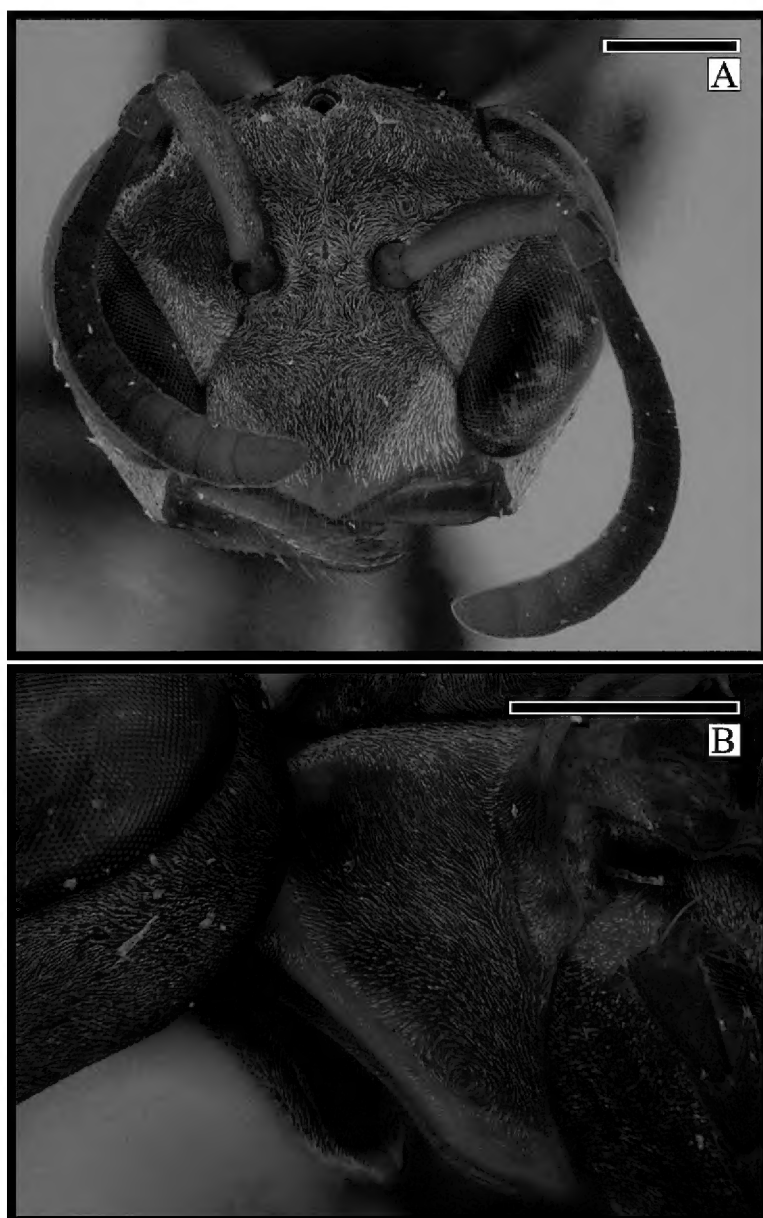


Figure 2. *Metapolybia carpenteriana* **A** head, frontal view **B** pronotum, lateral view. Scale bars: 0.5 mm.

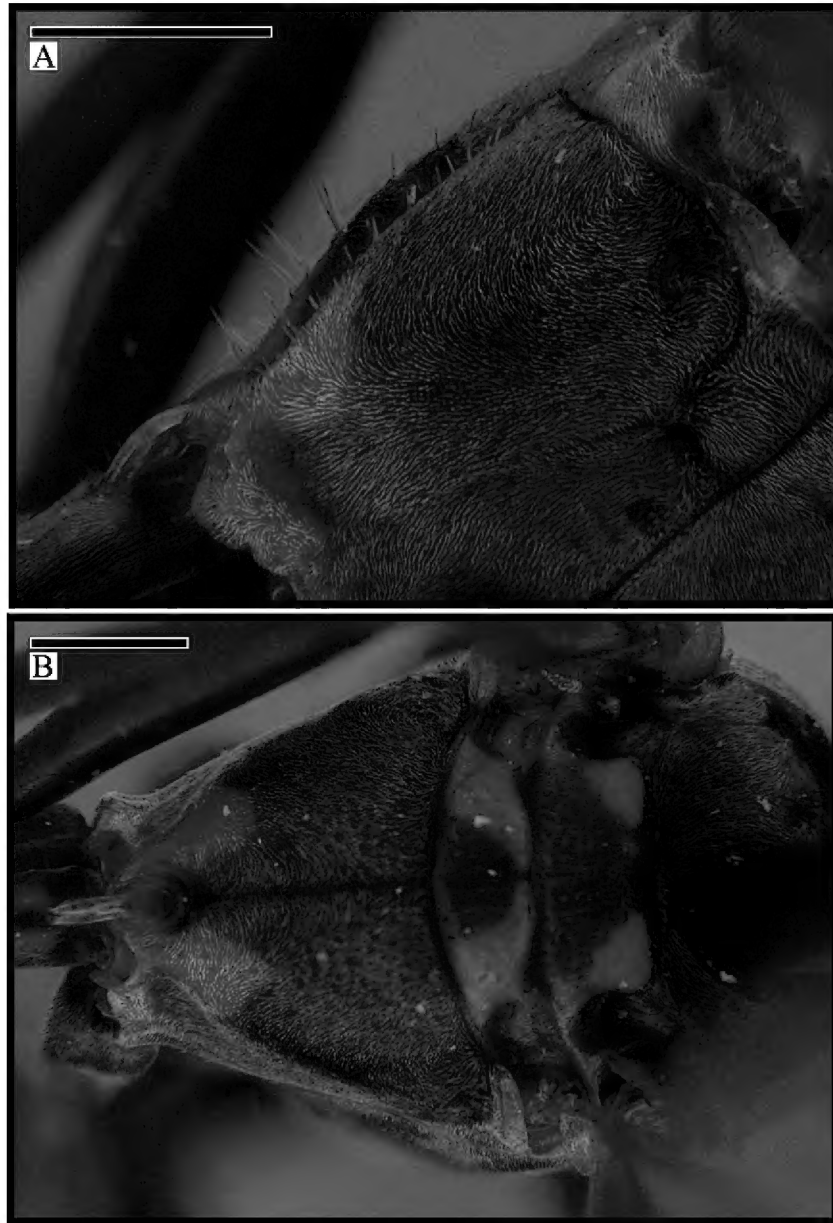


Figure 3. *Metapolybia carpenteriana* **A** propodeum, lateral view **B** propodeum, dorsal view. Scale bars: 0.5 mm.

Metasoma: (1) first metasomal tergum filiform, widening little after the prominent spiracles, slightly convex in lateral view, moderately prominent after spiracles; (2) second metasomal tergum 1.5 times wider than long, coriaceous (3) tergum three to six moderately to densely punctured.

Male. Like female except for the more extensive yellow spots; mandibles entirely yellow; clypeus yellow with a very small brown spot dorsally; tip of clypeus rounded–truncate, compressed, narrower with silvery pubescence, and fewer and shorter bristles; fore coxae almost entirely yellow; dorsal region of mid and hind coxae also yellow; gena narrower; excavation on posterior region of head less distinct, more rounded.

Male genitalia: see male genitalia description section below.

Nest. Unknown.

Distribution. Ecuador: Napo; Peru: Loreto.

Type material. Holotype. ECUADOR • 1 female; Prov. Napo, 10 km W Misahualli; 16 Dec. 1990; Carpenter & Wenzel; Nest 901216-4; **AMNH**.

Paratype. ECUADOR • 19 females, 2 males; same data as for holotype; one male with extracted genitalia pinned together; **AMNH**.

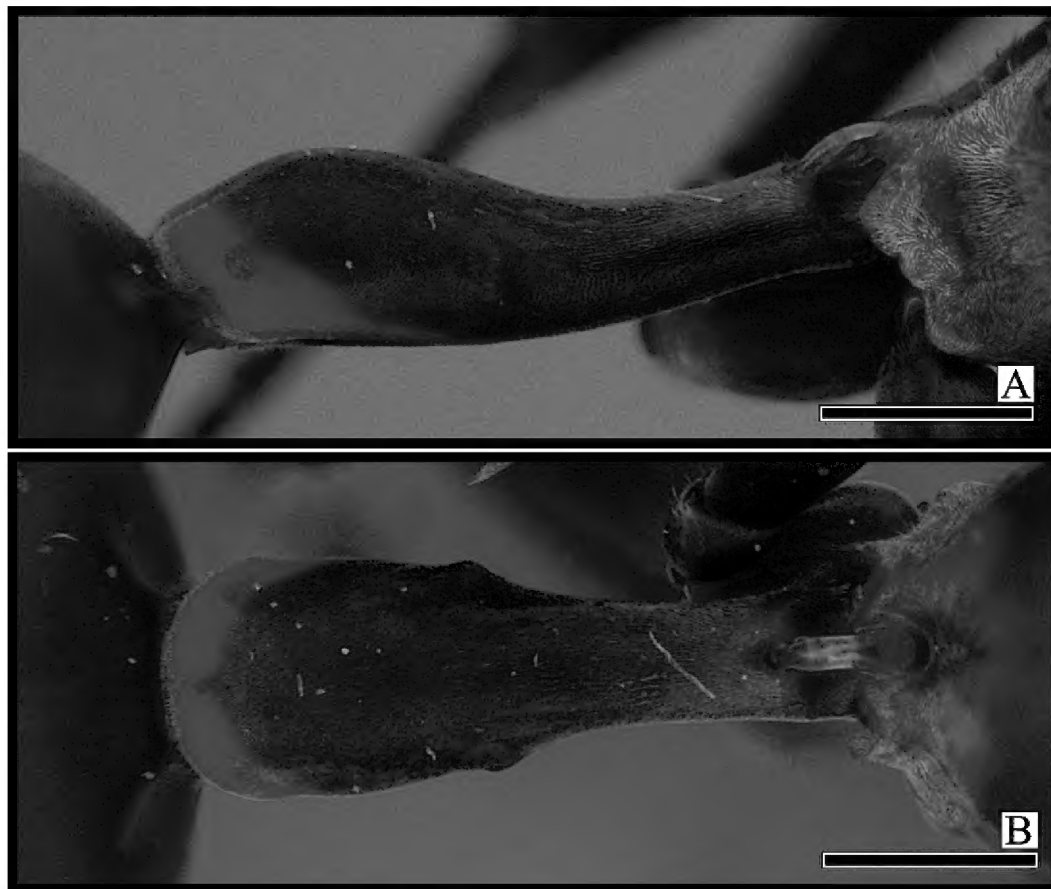


Figure 4. *Metapolybia carpenteriana* **A** tergum I, lateral view **B** tergum I, dorsal view. Scale bars: 0.5 mm.

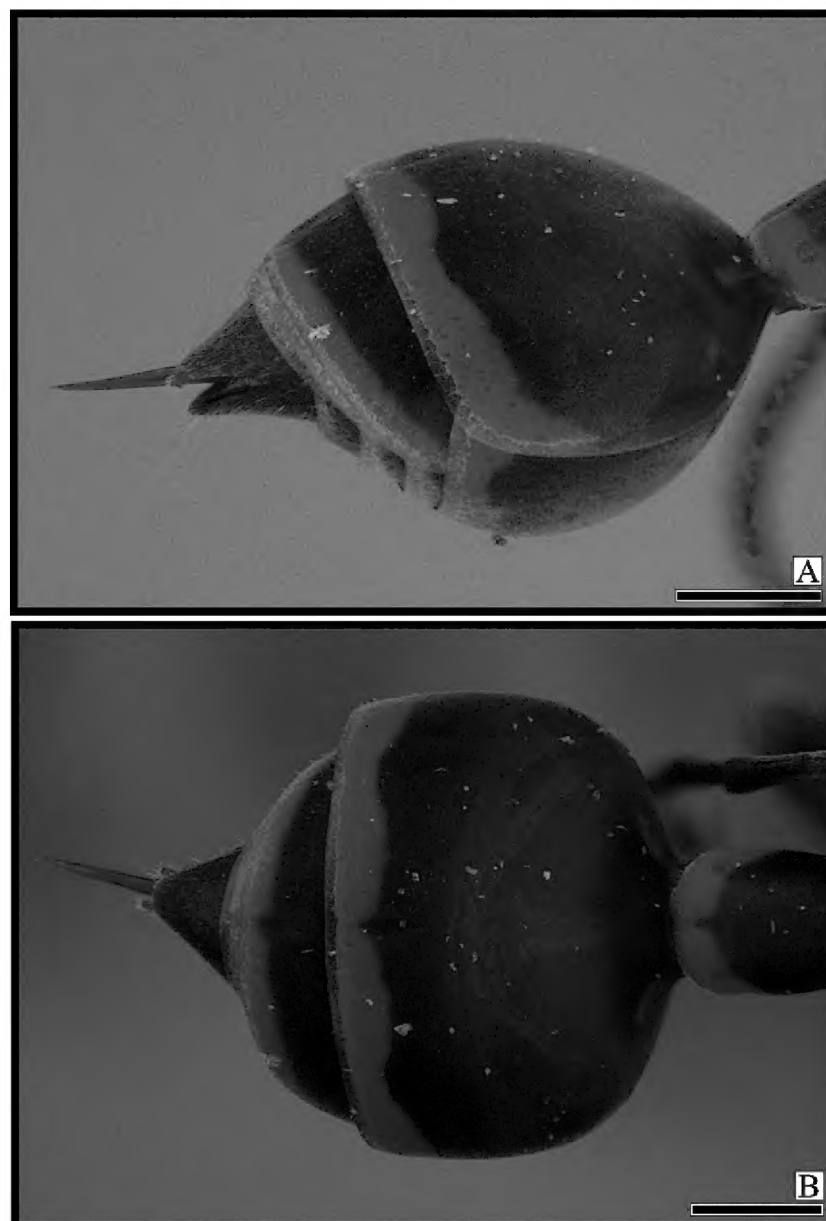


Figure 5. *Metapolybia carpenteriana* **A** metasoma, lateral view **B** metasoma, dorsal view. Scale bars: 0.5 mm.

Other material. ECUADOR • 51 females, 4 males; same data as for holotype. PERU • 15 females; Loreto, Iquitos, Rio Nanay; 2 Jan. 1991; Carpenter & Wenzel; Nest 910102-3; AMNH.

Etymology. The specific name honors Dr. James M. Carpenter, who recognized all these new species described in this work and asked us to describe them, and also for his contribution to the knowledge on the systematics of Vespidae around the world.

***Metapolybia pseudodocilis* Cortes, sp. nov.**

<https://zoobank.org/47ADD83B-B7A3-442B-9F00-6B2D6A52A5A0>

Figs 6–9

Diagnosis. Brownish species, head blackish. Very similar to the reddish form of *M. docilis* which can be separated by its broader and more strongly striated propodeal concavity and the lateral pronotal carina more raised and acute. Also, this species is similar in color to *M. rufata*, *M. encantata*, *M. suffusa* and *M. carpenteriana* but with a strong sculpture overall, especially on mesosoma and propodeum, and the yellow markings reduced compared to the latter two.

Description. Female. Size: 6.6 mm. Length of fore wing 4.5 mm.

Color: Brownish species, head blackish with yellow markings as follows: spot on dorsal margin of mandibles, near base; band on apical margin of clypeus, almost reaching the yellow lateral lobes; spots on inner orbits; antennae reddish brown dorsally

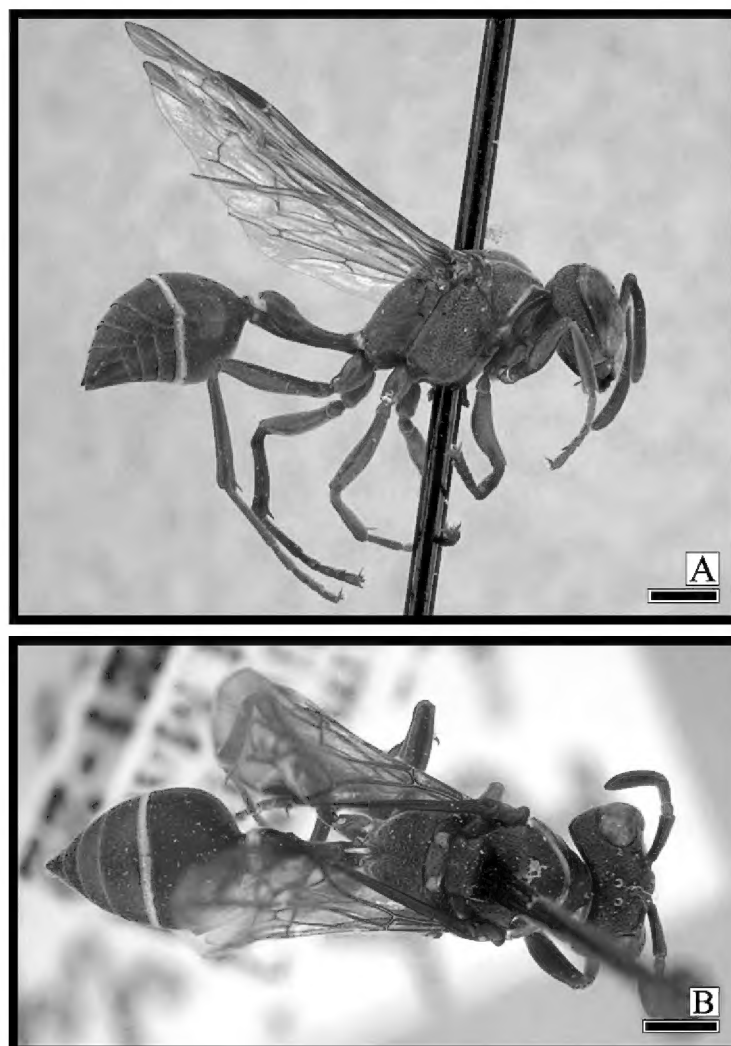


Figure 6. *Metapolybia pseudodocilis* **A** lateral View **B** dorsal view. Scale bars: 1.0 mm.

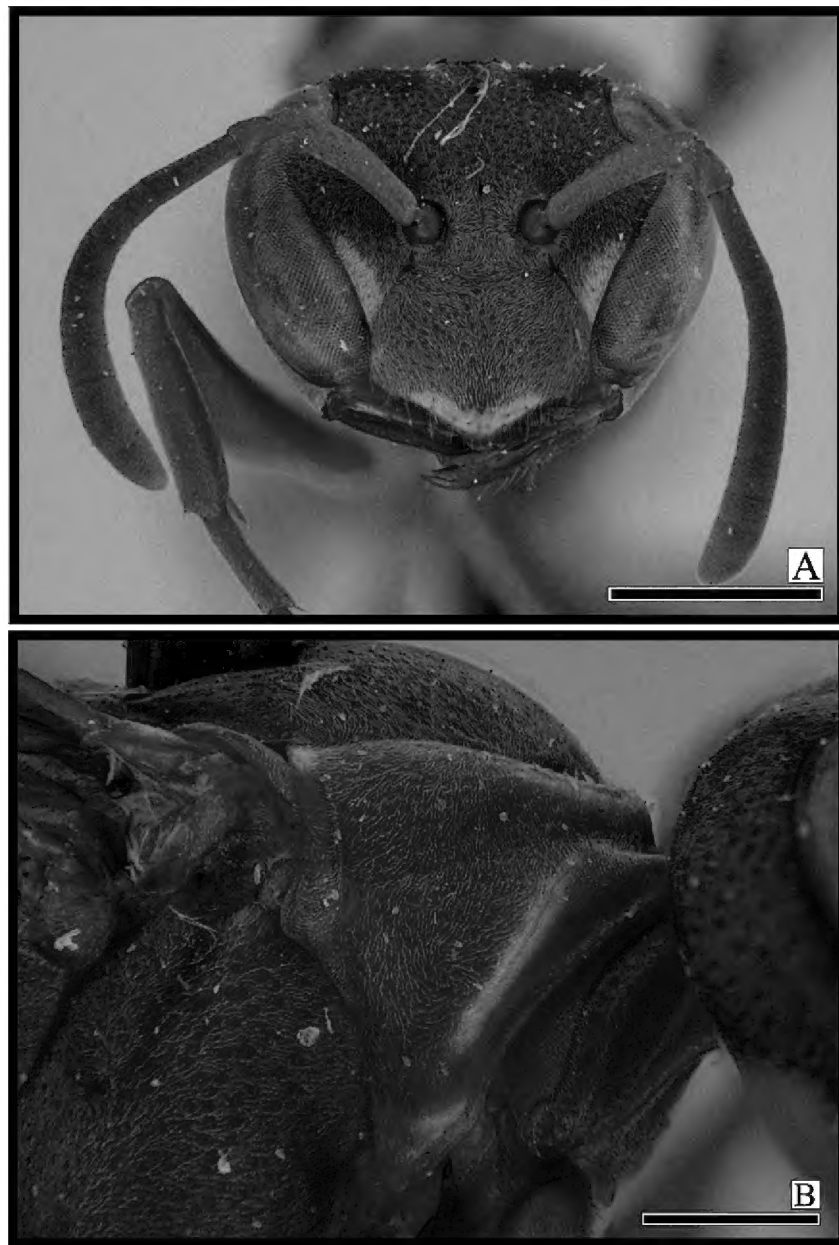


Figure 7. *Metapolybia pseudodocilis* **A** head, frontal view **B** pronotum, lateral view, Scale bars: 1.0 mm (**A**); 0.5 mm (**B**).



Figure 8. *Metapolybia pseudodocilis*. Propodeum, dorsal view. Scale bar: 0.5 mm.

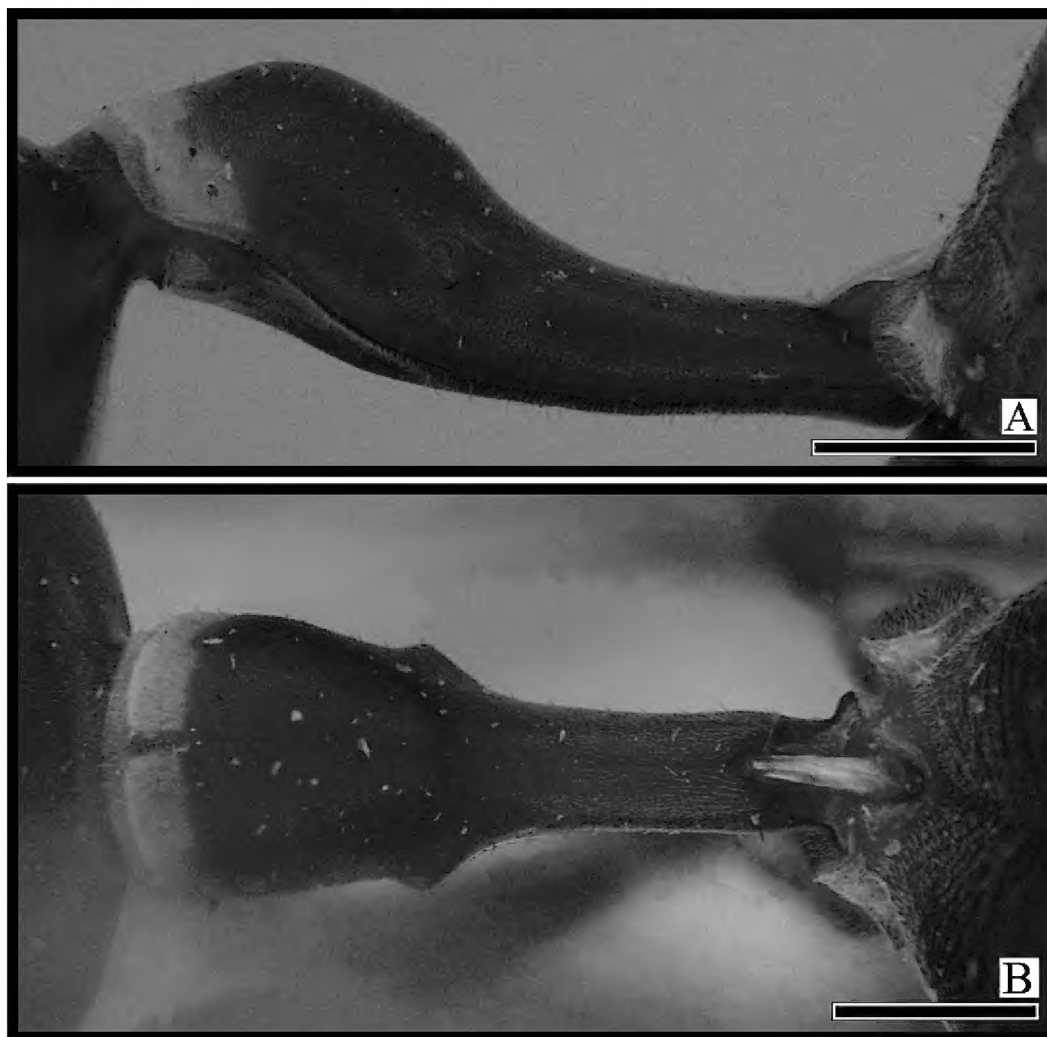


Figure 9. *Metapolybia pseudodocilis* **A** tergum I, lateral view **B** tergum I, dorsal view. Scale bars: 0.5 mm.

and yellowish beneath; small spot on inferior end of anterior margin of pronotum; lateral pronotal carina entirely yellow; band on posterior dorsal margin of pronotum, reaching both tegulae; lamellae behind pretegular carina yellow; sometimes small spot on metapleura by the dorsal end of scrobal furrow; two lateral, sometimes evanescent, yellow spots on scutellum and metanotum; propodeum with two spots on posterior margin near the yellow propodeal valves; legs reddish; wings hyaline, venation white brown; metasoma with yellow bands on tergum I–II and sternum I–II, and evanescent bands on tergum III and sternum III. Body covered with a whitish tomentum. Wings hyaline, venation brown.

Head: (1) clypeus 1.5 times wider than longer, punctures dense, separated by 1.0 diameter or less; (2) inter-antennal prominence raised and acute, with a marked medial furrow; (3) frons and vertex with dense punctures, separated by less than 1.0 diameter (4) gena 0.90–0.95 wider than width of eyes, strongly narrowing to mandibular condyle; punctures dense and coarse; (5) tempora slightly narrowing to vertex; (6) posterior region of head rounded, moderately emarginated.

Mesosoma: (1) lateral pronotal carina raised, subacute; (2) humeri not produced at all in front of tegula; (3) pretegular carina rounded on upper region, curved, not interrupted; (4) scutum 1.3 times wider than longer with punctures small, moderately deep, separated by about 1–2 diameters; (5) mesopleuron with dense and coarse punctures, separated by 1.0 diameter or less; (6) scutellum with deep punctures, spaced,

moderately concave posteriorly, medial line raised anteriorly, vanishing posteriorly; (7) metanotum strongly concave; (8) metapleuron with scattered and shallow punctures, upper plate rugose, 1.5 times longer than wide; (9) propodeum strongly punctured with short and scattered hairs; (10) propodeal concavity broad and deep, weakly developed anteriorly, striation very strong, extending laterally; (11) prestigma as long as wide, tip rounded.

Metasoma: (1) first metasomal tergum filiform, widening little after the prominent spiracles; posteriorly convex in lateral view, strongly prominent; (2) second metasomal tergum 1.8 times wider than longer, coriaceous, finely punctured on posterior fifth; (3) terga three to six brownish, densely punctured.

Variation: One paratype with more extensive yellow markings. Lateral spots on scutellum and metanotum are brighter and bigger, scutellum with an additional small spot on the center. Spots on propodeum are larger, reaching half of posterior face length.

Male. Unknown.

Nest. Unknown.

Distribution. Bolivia: La Paz.

Type material. Holotype: BOLIVIA • female; La Paz, Tumupasa; Dec.; W. M. Mann; Mulford Biol. Expl. 1921-22 (AMNH).

Paratype: Bolivia • 3 females; same locality as holotype.

Etymology. Due to the similarities of this species with *M. docilis*, the prefix *pseudo* means ‘false’ *docilis*.

***Metapolybia richardsi* Andena, sp. nov.**

<https://zoobank.org/85763BAD-1611-4601-B4B7-EAE4C39562C4>

Figs 10–12

Diagnosis. Very similar to *M. fraudator*, except its scutum narrower, the lateral pronotal carina not effaced on ventral corner, metapleural-propodeal furrow vanishing and the evanescent weak yellow markings overall; pretegular carina like in *M. fraudator*.

Description. Female. Size: 8.3 mm. Length of fore wing: 5.0 mm

Color: Black species with yellow markings as follows: spots on inner orbits and tip of clypeus; Tergum I with weak yellow band; Sternites II–III with weak yellow bands; terga III–VI, without yellow bands. Mandibles, antennal articles and scape blackish/brownish. Wings hyaline, venation brown.

Head: (1) clypeus 1.3 times wider than longer, punctures shallow, scattered, separated by more than 2.0 diameters; bristles extending all the way down, not forming a polished rim; (2) internantennal prominence raised, subacute, with a marked medial furrow; (3) frons and vertex covered with yellowish pubescence; punctures small, distinct, separated by 1–1.5 diameters, becoming sparser on vertex; (4) gena 0.7 wider than width of the eyes, strongly narrowing to mandibular condyle; punctures very small, scattered, pubescence very reduced; (5) tempora narrowing to vertex; (6) posterior region of the head excavated, strongly emarginated behind.

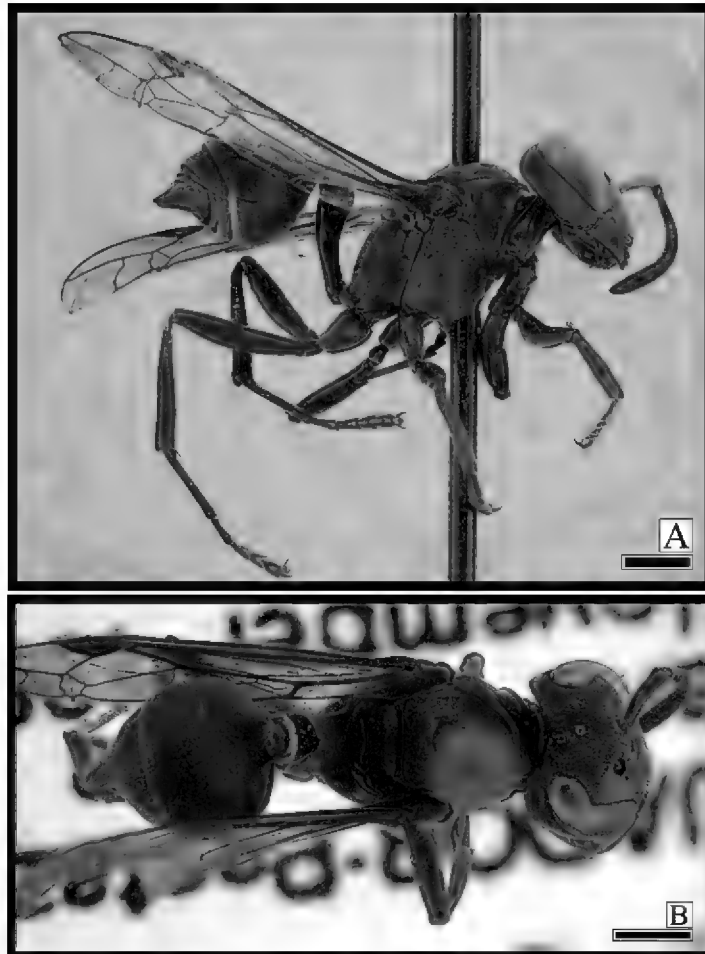
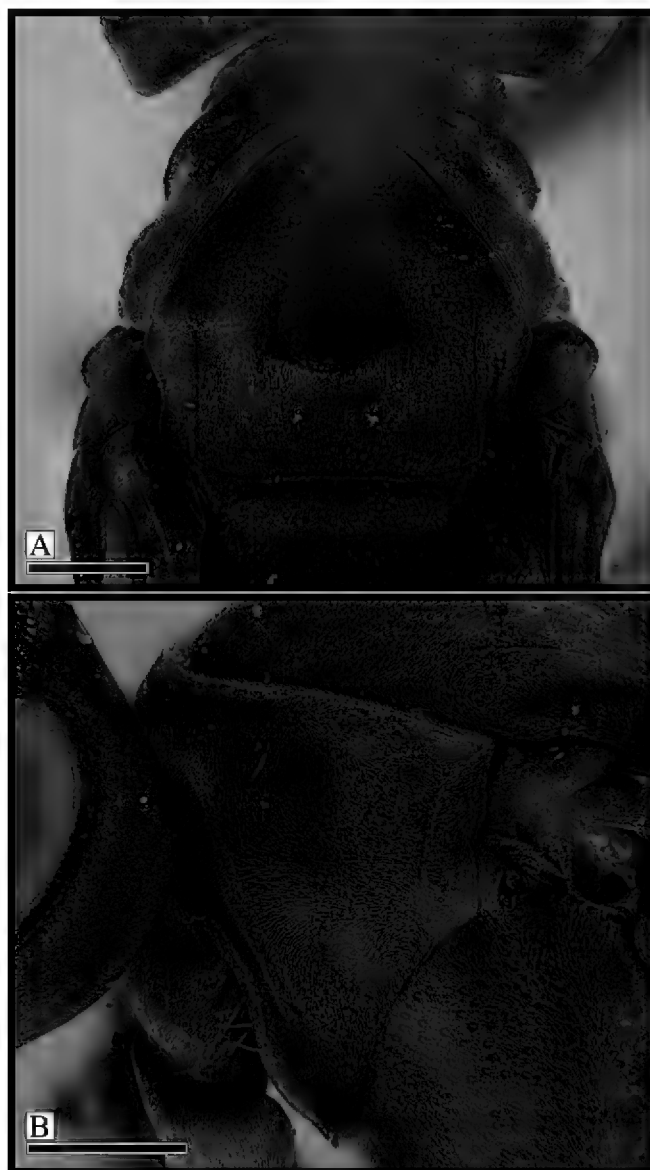


Figure 10. *Metapolybia richardsi* **A** lateral view **B** dorsal view. Scale bars: 1.0 mm.



Figures 11. *Metapolybia richardsi* **A** scutum, dorsal view **B** pronotum, lateral view. Scale bars: 0.5 mm.

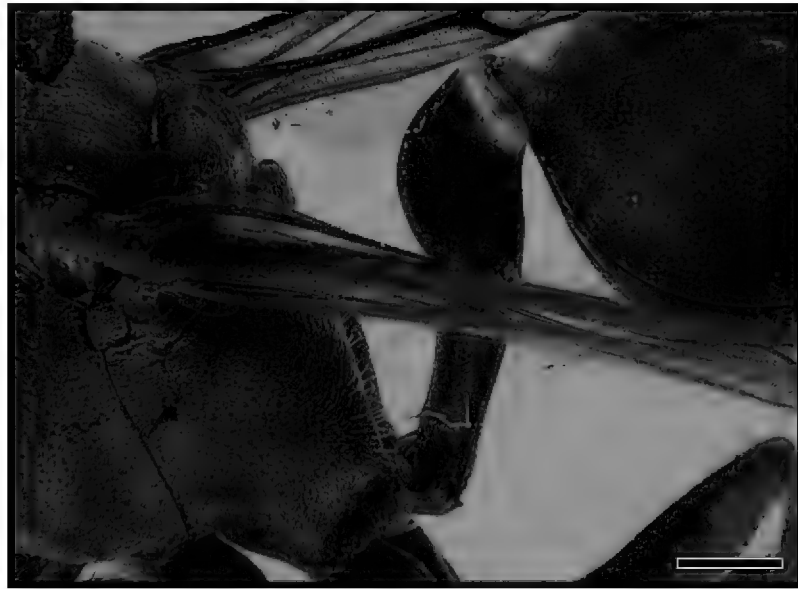


Figure 12. *Metapolybia richardsi*. Propodeum and tergum I, lateral view. Scale bar: 0.5 mm.

Mesosoma: (1) lateral pronotal carina raised, acute; pronotum with shallow and scattered punctures; (2) humeri produced in front of tegula, subacute; (3) pretegular carina acute on upper region, curved, not interrupted, not prominent; (4) scutum as long as wide, punctures small, shallow, scattered; (5) mesopleuron with shallow punctures separated by more than 2.0 diameters; (6) scutellum with small, though distinct punctures, separated by 1.0 diameter, slightly concave posteriorly, medial line raised anteriorly, vanishing posteriorly; (7) metanotum strongly concave with scattered punctures; (8) metapleuron with few scattered punctures, upper plated 1.3 times longer than wide; (9) propodeum with shallow scattered punctures with moderate long and sparse hairs on posterior region; (10) propodeal concavity broad, moderately deep, weakly developed anteriorly, striation distinct, extending laterally; (11) prestigma as long as wide, tip truncate.

Metasoma: (1) first metasomal tergum filiform, widening little after the prominent spiracles; prominent (2) tergum II 1.2 times wider than longer, coriaceous, punctures distinct on posterior fifth; (3) terga III–VI densely punctured.

Male. Unknown.

Nest. Unknown.

Distribution. Ecuador: Pastaza.

Holotype. ECUADOR • 1 female; Pastaza, Jibaria, Shurupe; 7 Nov. 1987; Mike Huybensz; AMNH.

Etymology. The specific name honors O.W. Richards for his contribution of the knowledge of the social wasps.

***Metapolybia sulamerica* Carpenter, sp. nov.**

<https://zoobank.org/F3A53BE5-1A87-4ACD-8071-951B80FD9F01>

Figs 13–16

Diagnosis. This species is like *M. servilis*, however the lateral pronotal carina its less raised and somewhat sharp; propodeal concavity broader and deeper; clypeus wider.

Plus, *M. sulamerica* has the integument of the mesosoma and metasoma brownish with yellow markings reduced and less distinct than the blackish *M. servilis*.

Description. Female. Size: 5.5 mm. Length of fore wing 5.0 mm

Color: Brownish species, head blackish with yellow markings as follows: spots on mandibles near condyle and ventral margin of clypeus; weak spots on inner orbits, anterior region of pronotal carina, axillae, metanotum.; bands on posterior region of tergum I–II and sternum I; weak bands on tergum III–IV. Tegula yellowish with brown spots. Antennal articles brownish, scape yellowish beneath. Legs brown. Wings hyaline, venation brown.

Head: (1) clypeus 1.2 times wider than longer; ventral margin with a reduced yellow band; punctures very shallow, scattered, separated by more than 2.0 diameters; erect hairs on first 2/3; (2) inter-antennal prominence little raised, truncate to subacute, with a weak medial furrow; (3) frons and vertex covered with a yellowish pubescence, punctures shallow, dense, separated by about 1 diameter, becoming sparser on vertex; (4) gena 0.85–0.90 wider than width of the eyes, strongly narrowing to mandibular condyle, punctures weak, scattered, pubescence yellowish; (5) tempora narrowing to vertex; (6) posterior region of the head rounded, moderately emarginated.

Mesosoma: (1) lateral pronotal carina little raised, subacute,; punctures shallow, small, though distinct, separated by more than 2.0 diameters; (2) humeri scarcely

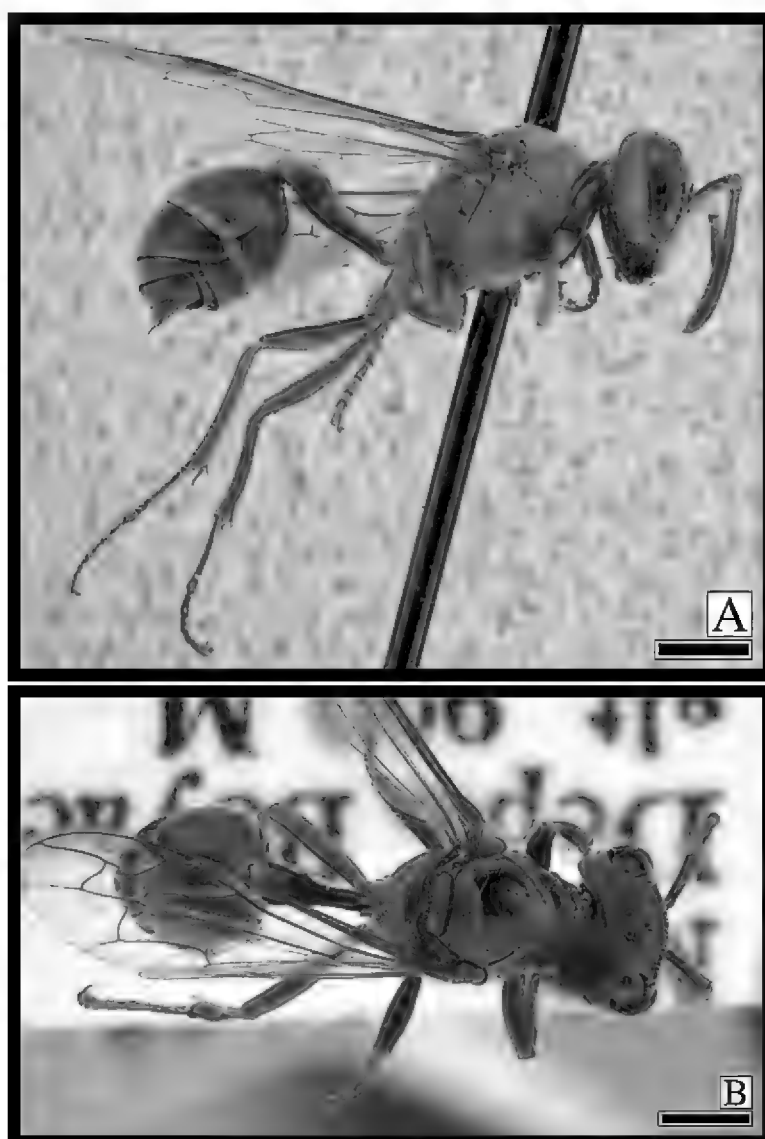


Figure 13. *Metapolybia sulamerica* **A** lateral view **B** dorsal view. Scale bars: 1.0 mm.

produced in front of tegula, gently rounded; (3) pretegular carina rounded, not acute, not interrupted; (4) scutum 1.2 times wider than long with scattered punctures; (5) mesopleura with punctures separated by about 1.0–1.4 diameters mostly concentrated on posterior region; (6) scutellum with distinct punctures, slightly concave posteriorly; medial line raised anteriorly, complete posteriorly; (7) metanotum strongly concave, punctures sparse; (8) metapleuron with scattered punctures, upper plate as long as wide or 1.3 times longer than wide, punctures denser than lower plate; (9) propodeum with scattered short hairs, propodeal concavity shallow, almost flat, weakly striate, not extending laterally; (10) prestigma as long as wide, tip truncate.

Metasoma: (1) First metasomal tergum filiform, widening little after strong spiracles, strongly convex posteriorly in lateral view, prominent; (2) second metasomal tergum 1.2 times wider than long, coriaceous; (3) terga III–VI finely punctured.

Variation: Some of the specimens labelled as “nest on tree July 3” have the yellow markings on head and metanotum absent or evanescent. Some specimens from both nests have stronger striae on broader propodeal medial furrow than holotype.

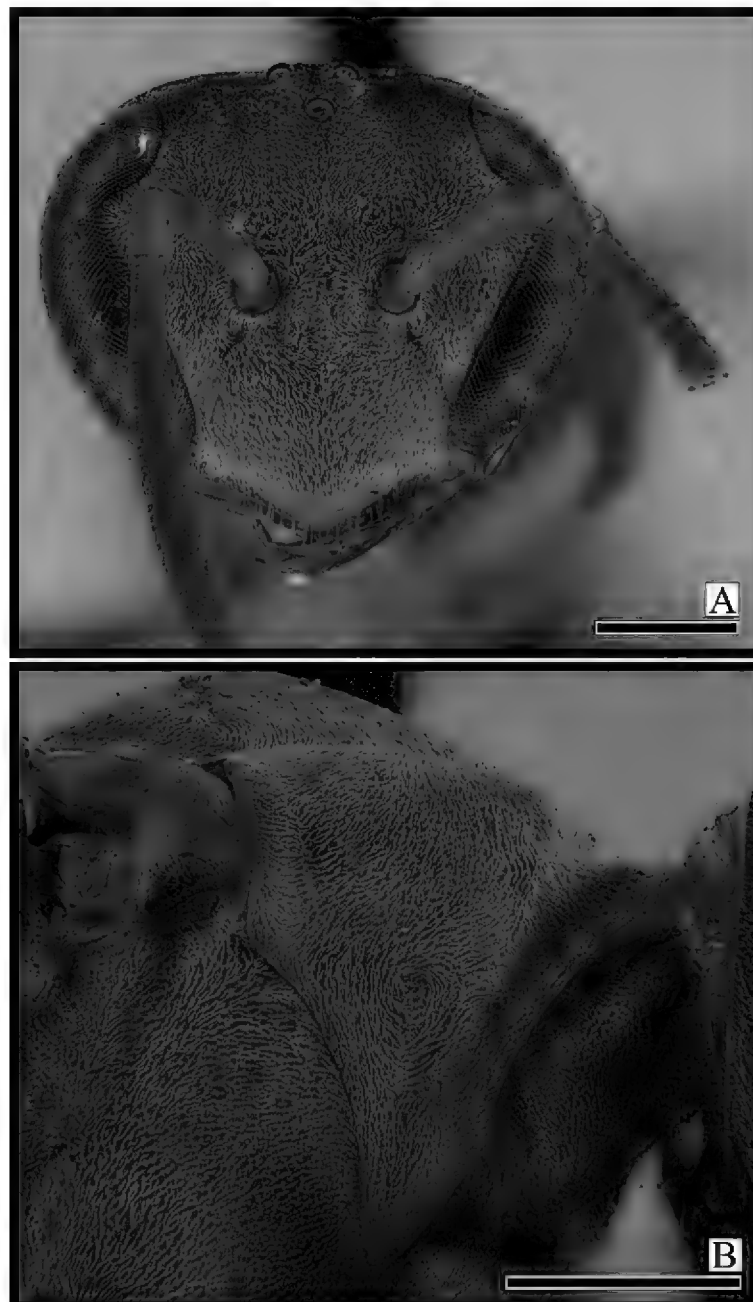


Figure 14. *Metapolybia sulamerica* **A** head, frontal view **B** pronotum, lateral view. Scale bars: 0.5 mm.

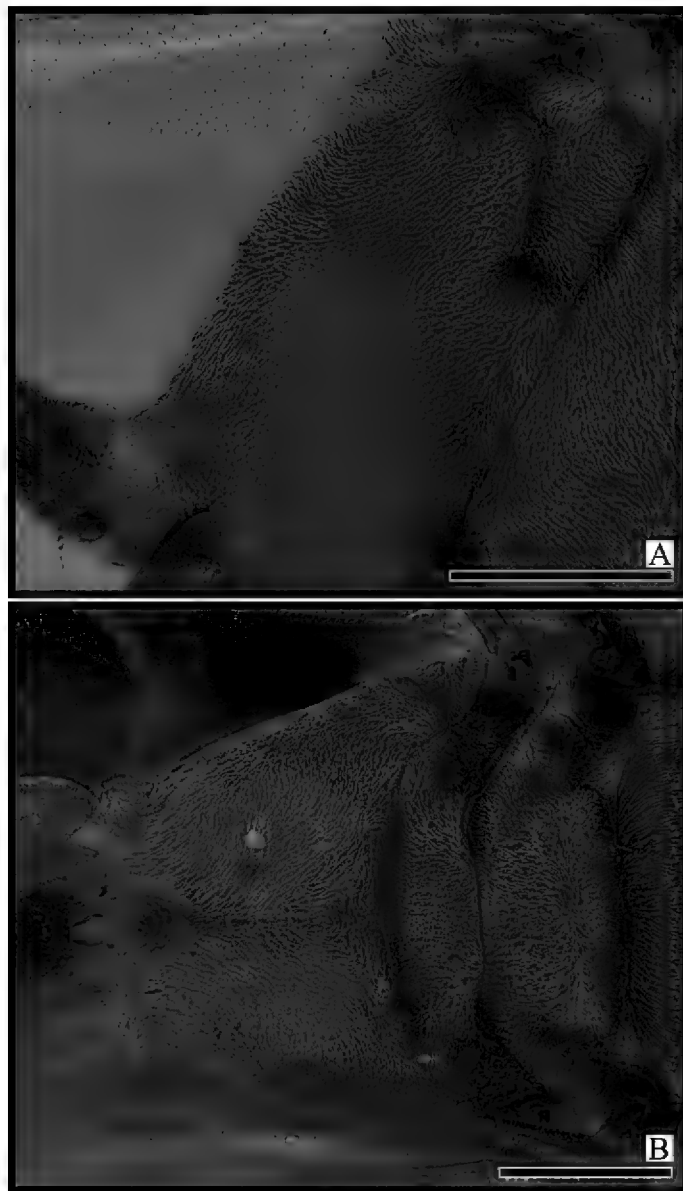


Figure 15. *Metapolybia sulamerica* **A** propodeum, lateral view **B** propodeum, dorsal view. Scale bars: 0.5 mm.

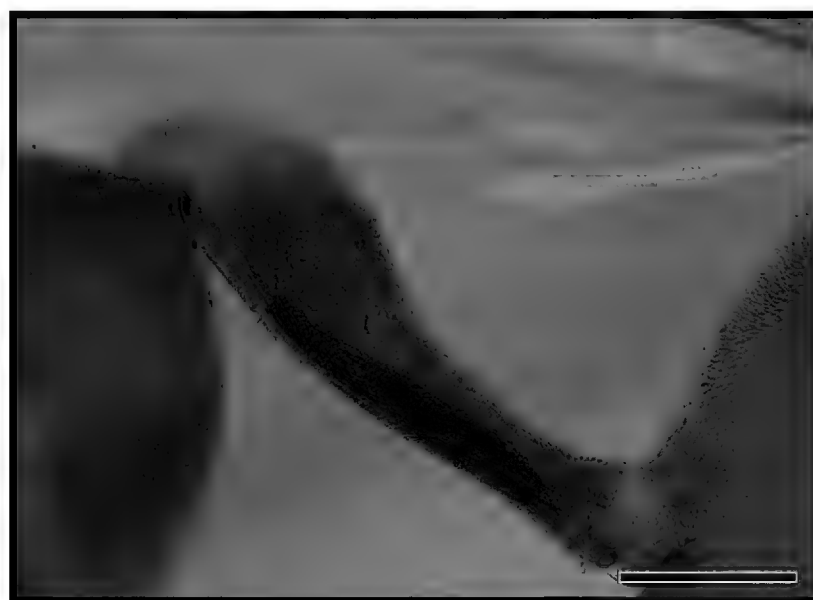


Figure 16. *Metapolybia sulamerica*. Tergo I, lateral view. Scale bar: 0.5 mm.

Male. like female, except for denser and shinier tomentum; narrower clypeus and gena, and more distinct punctures overall, especially the coarser punctures on mesopleura.

Male genitalia: see male genitalia description section below.

Nest. Unknown.

Distribution. Colombia: Boyacá.

Type material. *Holotype.* COLOMBIA • 1 female; Boyacá, Muzo; alt. 900 m.; 2 Jul. 1936; J. Bequaert; “nest in village July 2”; AMNH.

Paratype. Colombia • 10 females, 4 males; same data as for holotype; one with extracted genitalia pinned together; AMNH • 4 females; same locality as for holotype; “nest on tree July 3”; AMNH.

Other material. COLOMBIA • 4 females; same data as for holotype; AMNH • 7 females; same locality as for holotype; “nest on tree”; AMNH • 3 females; same locality as for holotype; AMNH.

Etymology. The specific name is a reference to the geographic distribution of the species.

***Metapolybia zucchini* Andena & Carpenter, sp. nov.**

<https://zoobank.org/F7594BEF-B297-4139-8ADB-6D127A892BB1>

Figs 17–20

Diagnosis. The species is easily recognized by its prominent aberrant propodeum, especially bulging laterally which is different of any other species of *Metapolybia* (see description).

Description. Female. Size: 6.0 mm. Length of fore wing: 5.0 mm.

Color: Blackish/brownish species. Mandibles, dorsal antennae, tegula, metasoma and legs brownish. Weak yellow markings as follows: apical spot on mandibles; spot on the margin of clypeus and inner orbits; ventral antennae fading yellow apically; small yellow spot along the lateral pronotal carina, spot on lamella behind pretegular carina, and band on posterior margin of pronotum; Tergum I–VI brownish; yellow band present on tergum I–II and sternum II–III; wings hyaline, venation brown.

Head: (1) clypeus 1.3 times wider than longer, punctures shallow, spaced, separated by 2.0 diameters or more; bristles on first third, straight; (2) inter-antennal prominence moderately raised, subacute with weak medial furrow; (3) frons and vertex covered with yellowish pubescence, punctures denser than clypeus, separated by about 1.0–2.0 diameters, becoming sparser on vertex; (4) gena 0.85 wider than width of the eyes, strongly narrowing to mandibular condyle, punctures very small and scattered, pubescence reduced and concentrated on inferior region; (5) tempora narrowing to vertex; (6) posterior region of the head excavated, strongly emarginated.

Mesosoma: (1) lateral pronotal carina raised and acute; (2) humeri moderately produced in front of tegula, gently rounded; (3) pretegular carina acute on upper region, curved, not interrupted; (4) scutum 1.3 times wider than longer with very small and scattered punctures; (5) mesopleura with shallow punctures separated by 2 diameters, like those on clypeus; (6) scutellum with small and distinct punctures, separated by about 1.0–2.0 diameters slightly concave posteriorly, medial line

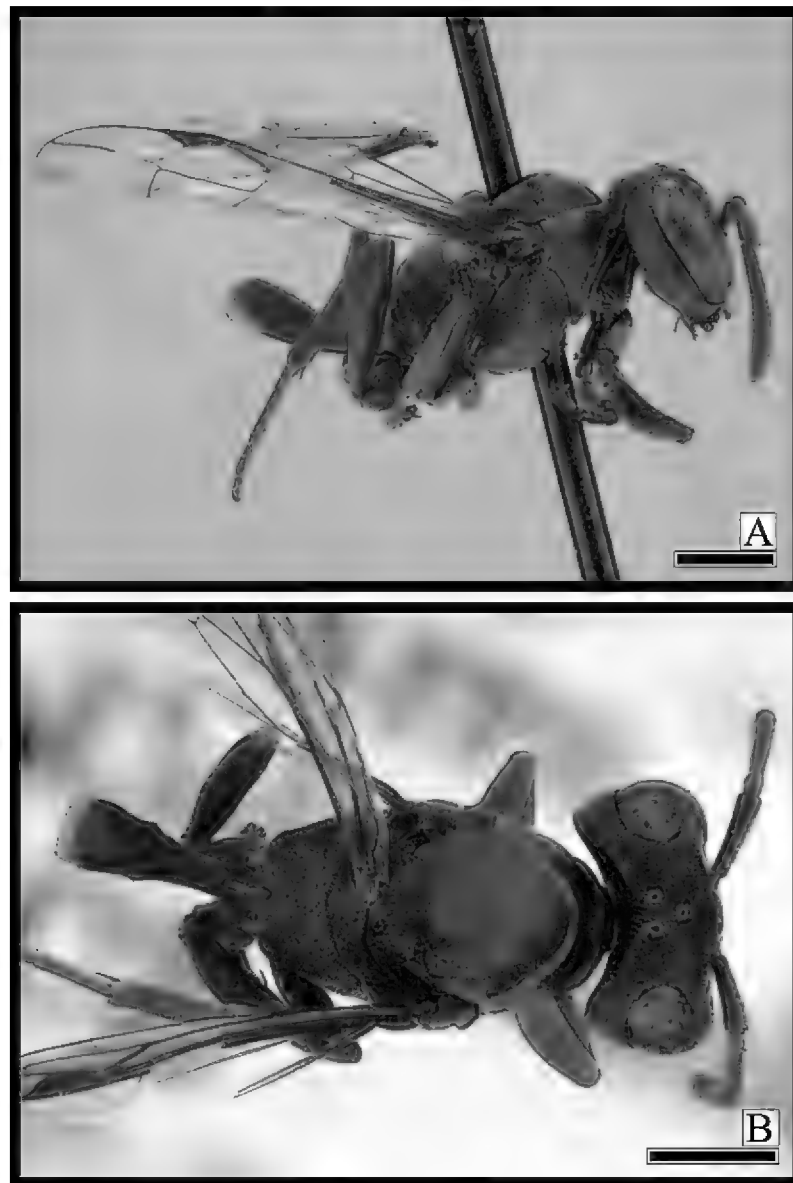


Figure 17. *Metapolybia zucchini* **A** lateral view **B** dorsal view. Scale bars: 1.0 mm.

raised anteriorly, vanishing posteriorly (7) metanotum strongly concave, pointed posteriorly; (8) metapleuron with scattered punctures, upper plate 1.3 times longer than wide; (9) propodeum strongly prominent latero-posteriorly, with short and sparse outstanding hairs concentrated on posterior region; (10) propodeal concavity weakly developed anteriorly, broad and deep posteriorly, striation weak, extending laterally; (11) legs brownish; (12) prestigma longer than wide, tip truncate.

Metasoma: (1) first metasomal tergum filiform, widening little after the prominent spiracles, posteriorly convex in lateral view, slightly prominent; (2) second metasomal tergum 1.2 times wider than long, coriaceous finely punctured on posterior fifth; (3) terga three to six densely punctured.

Male. Unknown.

Nest. Unknown.

Distribution. Panama, Barro Colorado Island.

Holotype. PANAMA • 1 female; Barro Colorado Island; P. Rau; col. #7666; determined as *Metapolybia azteca* by C.K. Starr 1980; AMNH.

Etymology. The specific name honors Dr. Ronaldo Zucchi, for his contribution of the knowledge of behavior of Neotropical bees and wasps.

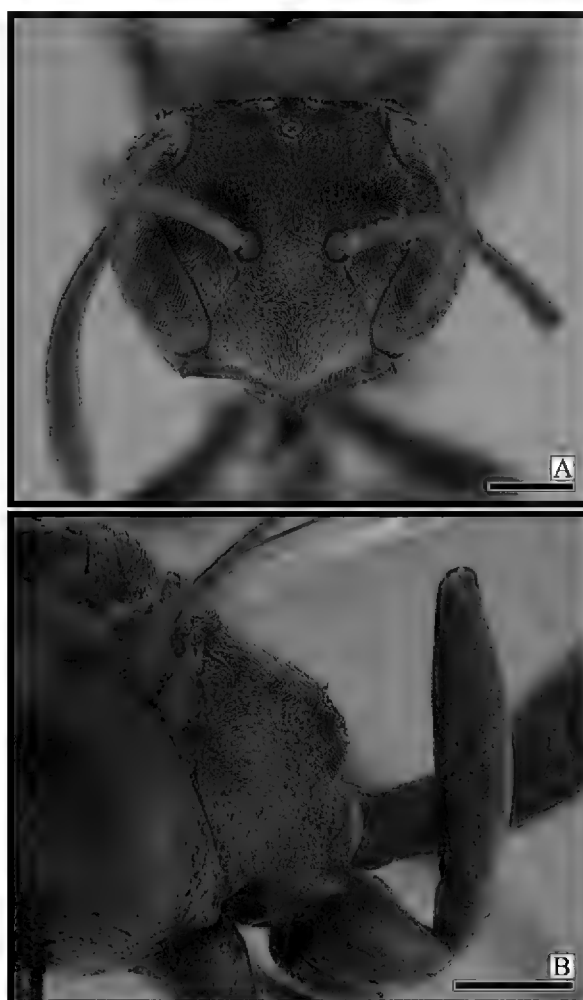


Figure 18. *Metapolybia zucchini* **A** head, frontal view **B** propodeum, lateral view. Scale bars: 0.5 mm.

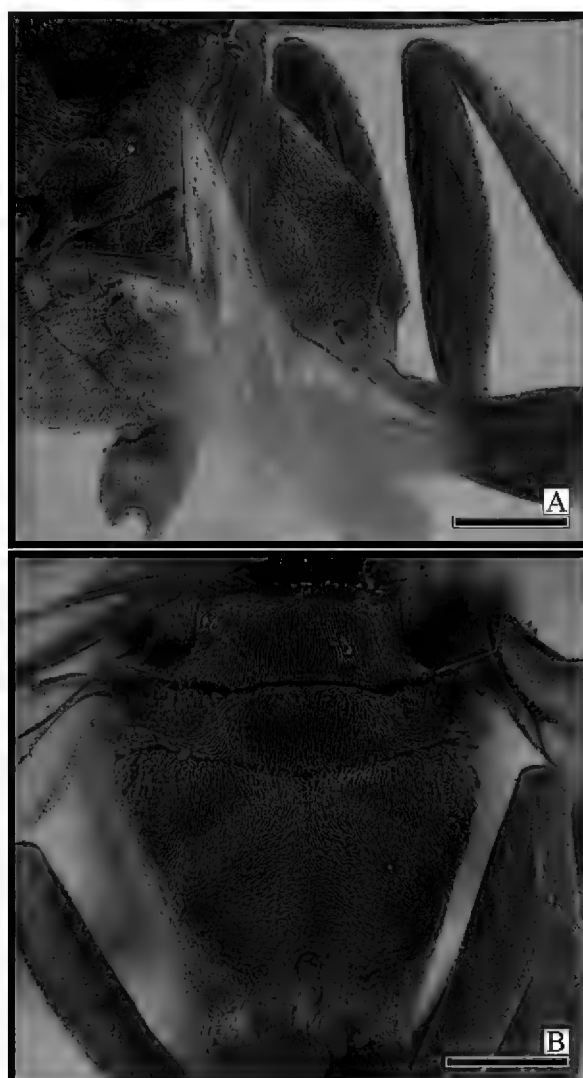


Figure 19. *Metapolybia zucchini* **A** propodeum, dorso-lateal view **B** propodeum, dorsal view. Scale bars: 0.5 mm.

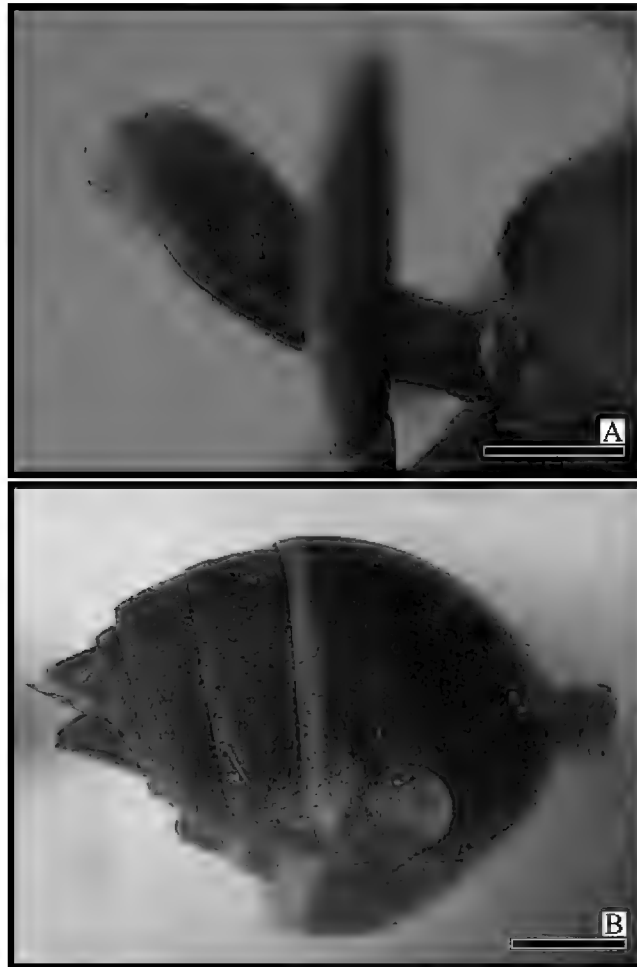


Figure 20. *Metapolybia zucchiana* **A** tergum I, lateral view **B** metasoma, lateral view. Scale bars: 0.5 mm.

Male genitalia descriptions

In this section we describe and depict the male genitalia of the following species: *Metapolybia bromelicola*, *M. carpenteriana*, *M. encantata*, *M. mesoamerica*, *M. rufata*, *M. servilis* and *M. sulamerica*.

Metapolybia bromelicola

Fig. 21A–E

Male genitalia. (1) paramere about 1.7 times longer than wide at middle, basal angle obtuse, apical angle truncate, spine of paramere long, pointed, bare (Fig. 21A); (2) aedeagus slightly curved, lobe rounded weakly produced, lateral margin produced; lateral ridge with a row of short teeth extending laterally; ventral process slightly produced, pointed (Fig. 21B, C); (3) cuspis long and pointed, with short and dense hairs apically, extending laterally (Fig. 21D); (4) digitus long apically, rounded, with short and dense hairs, mesal surface with scattered small punctures (Fig. 21E).

Material examined. BRAZIL • male; Rio de Janeiro, Itatiaia; AMNH.

Metapolybia carpenteriana

Fig. 21F–J

Male genitalia. (1) paramere about 1.5 times longer than wide at middle, basal angle obtuse, apical angle, prominent and truncate, spine of paramere long, pointed, bare

(Fig. 21F); (2) aedeagus curved, lobe rounded and produced, lateral margin produced; lateral ridge with a row of short teeth extending laterally; ventral process produced, pointed (Fig. 21G, H); (3) cuspis long and pointed and slightly curved, with short and dense hairs apically, extending laterally (Fig. 21I); (4) digitus short apically, blunt, with short and dense hairs, mesal surface with scattered small punctures (Fig. 21J).

Material examined. ECUADOR • paratype male; Napo, 10 km w Misahualli; 16 Dec. 1990; Carpenter & Wenzel; Nest 901216–4; **AMNH**.

Metapolybia encantata

Fig. 21K–O

Male genitalia. (1) paramere about 1.4 times longer than wide at middle, basal angle obtuse, apical angle truncate, spine of paramere long, pointed, bare (Fig. 21K); (2) aedeagus curved, lobe rounded and produced, lateral margin produced; lateral ridge with a row of short teeth extending laterally; ventral process produced, pointed (Fig. 21L, M); (3) cuspis long and rounded, with short and dense hairs apically, extending laterally (Fig. 21N); (4) digitus long apically, rounded, with short and dense hairs, mesal surface with scattered small punctures (Fig. 21O).

Material examined. COLOMBIA • male; El Encanto; **AMNH**.

Metapolybia mesoamerica

Fig. 22A–E

Male genitalia. (1) paramere about 1.5 times longer than wide at middle, basal angle obtuse, apical angle truncate, spine of paramere long, pointed, bare (Fig. 22A); (2) aedeagus curved, lobe rounded and strongly produced, lateral margin produced; lateral ridge with a row of short teeth extending laterally; ventral process produced, rounded (Fig. 22B, C); (3) cuspis long and pointed, with short and dense hairs apically, extending laterally (Fig. 22D); (4) digitus short apically, blunt, with short and dense hairs, mesal surface with scattered small punctures (Fig. 22E).

Material examined. COSTA RICA • male; Limon, Amubri; **AMNH**.

Metapolybia rufata

Fig. 22F–J

Male genitalia. (1) paramere about 1.6 times longer than wide at middle, basal angle obtuse, apical angle truncate, spine of paramere long, pointed, bare (Fig. 22F); (2) aedeagus curved, lobe rounded produced, lateral margin produced; lateral ridge with a row of short teeth extending laterally; ventral process produced, pointed (Fig. 22G, H); (3) cuspis long and pointed, with short and dense hairs apically, extending laterally (Fig. 22I); (4) digitus long apically, rounded, with short and dense hairs, mesal surface with scattered small punctures (Fig. 22J).

Material examined. BRAZIL • male; Mamiraua; **MPEG**.

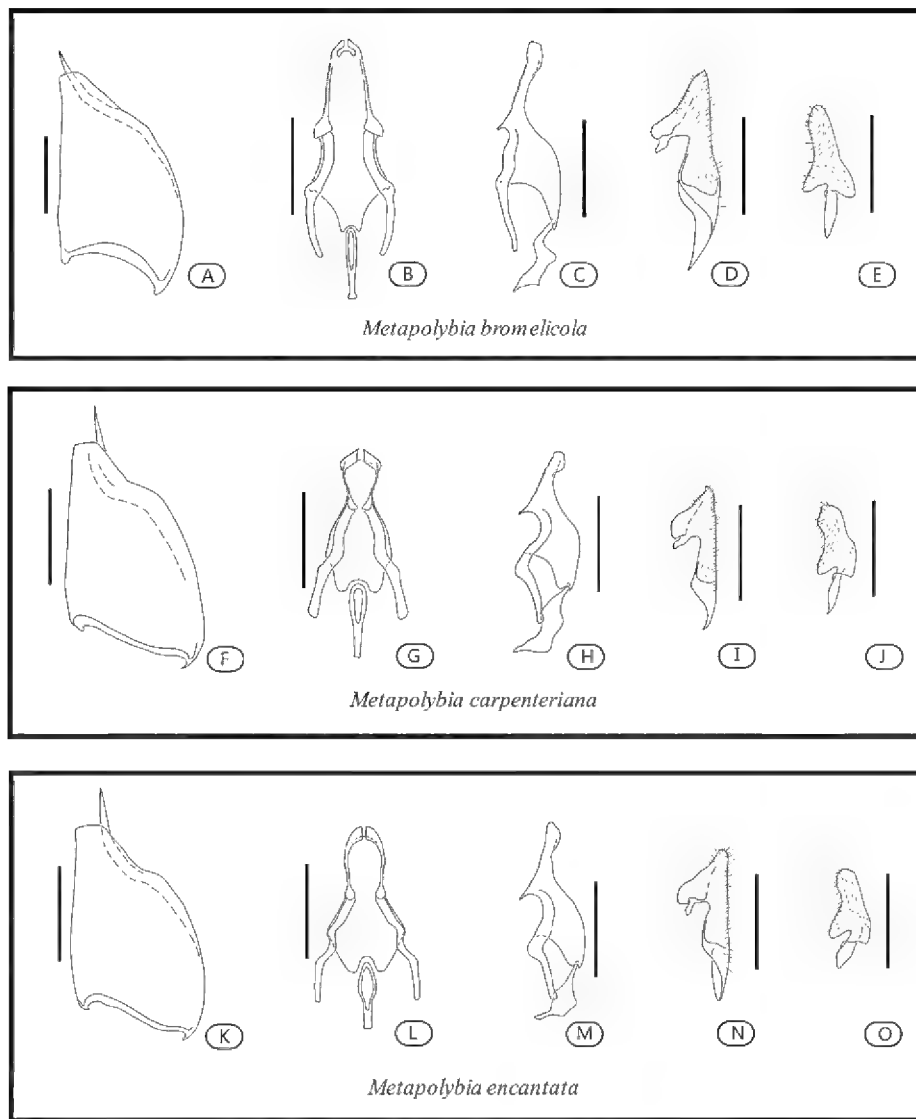


Figure 21. Male genitalia of *Metapolybia bromelicola* (A–E), *M. carpenteriana* (F–J) and *M. encantata* (K–O). A, F, K paramere B, G, L aedeagus, ventral view C, H, M aedeagus, lateral view D, I, N cuspis, lateral view E, J, O digitus, lateral view. Scale bars: 0.5 mm.

Metapolybia servilis

Fig. 22K–O

Male genitalia. (1) paramere about 1.5 times longer than wide at middle, basal angle obtuse, apical angle pointed, spine of paramere long, pointed, bare (Fig. 22K); (2) aedeagus curved, lobe rounded and strongly produced, lateral margin produced; lateral ridge with a row of short teeth extending laterally; ventral process produced, rounded (Fig. 22L, M); (3) cuspis long and pointed, with short and dense hairs apically, extending laterally (Fig. 22N); (4) digitus short apically, blunt, with short and dense hairs, mesal surface with scattered small punctures (Fig. 22O).

Material examined. PARAGUAY • male, paratype; Pto. Bertoni; NHM.

Metapolybia sulamerica

Fig. 23A–E

Male genitalia. (1) paramere about 1.8 times longer than wide at middle, basal angle obtuse, apical angle mostly truncate, spine of paramere long, pointed, bare (Fig. 23A);

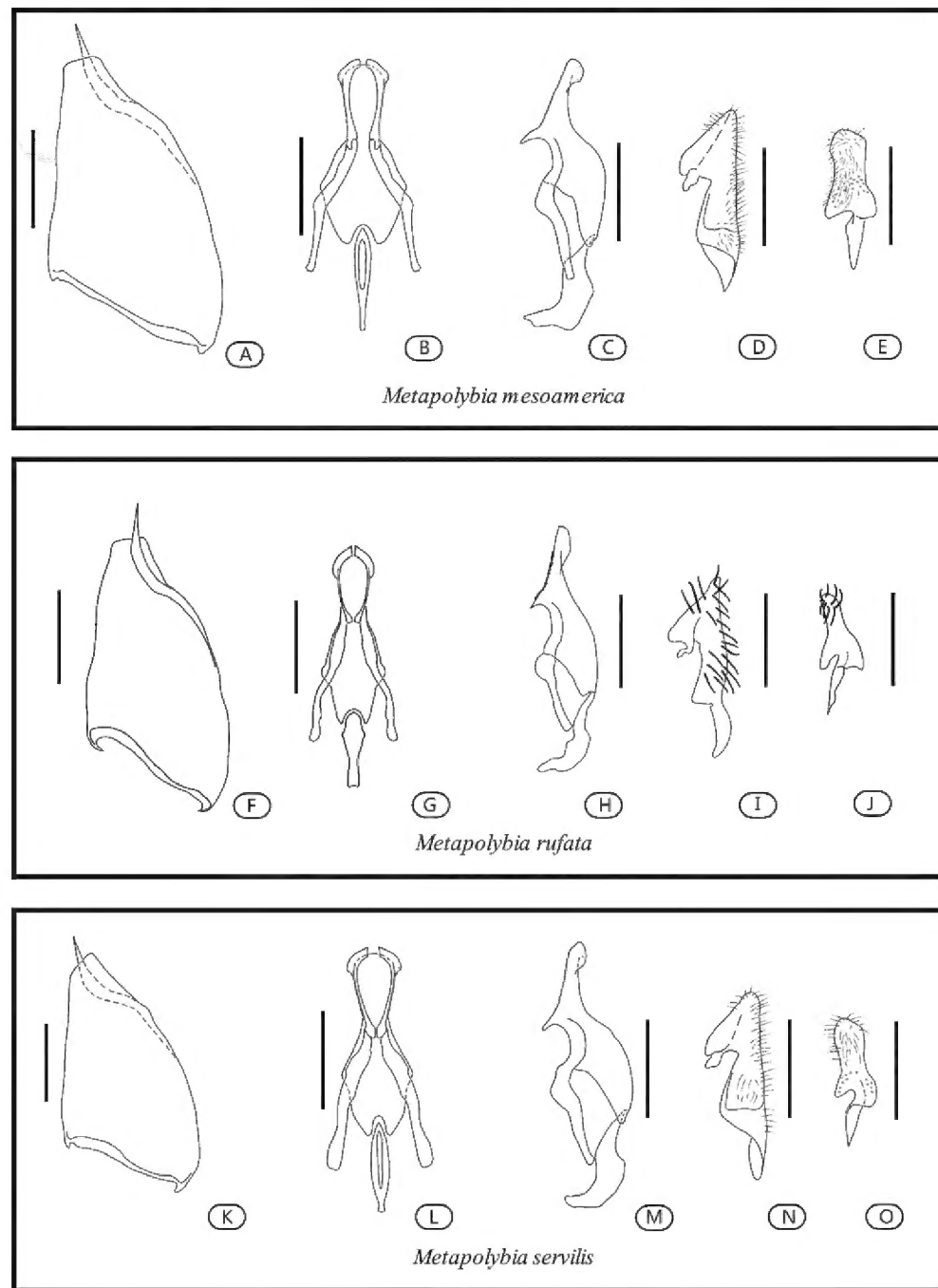


Figure 22. Male genitalia of *Metapolybia mesoamerica* (A–E), *M. rufata* (F–J) and *M. servilis* (K–O) **A, F, K** paramere **B, G, L** aedeagus, ventral view **C, H, M** aedeagus, lateral view **D, I, N** cuspis, lateral view **E, J, O** digitus, lateral view. Scale bars: 0.5 mm.

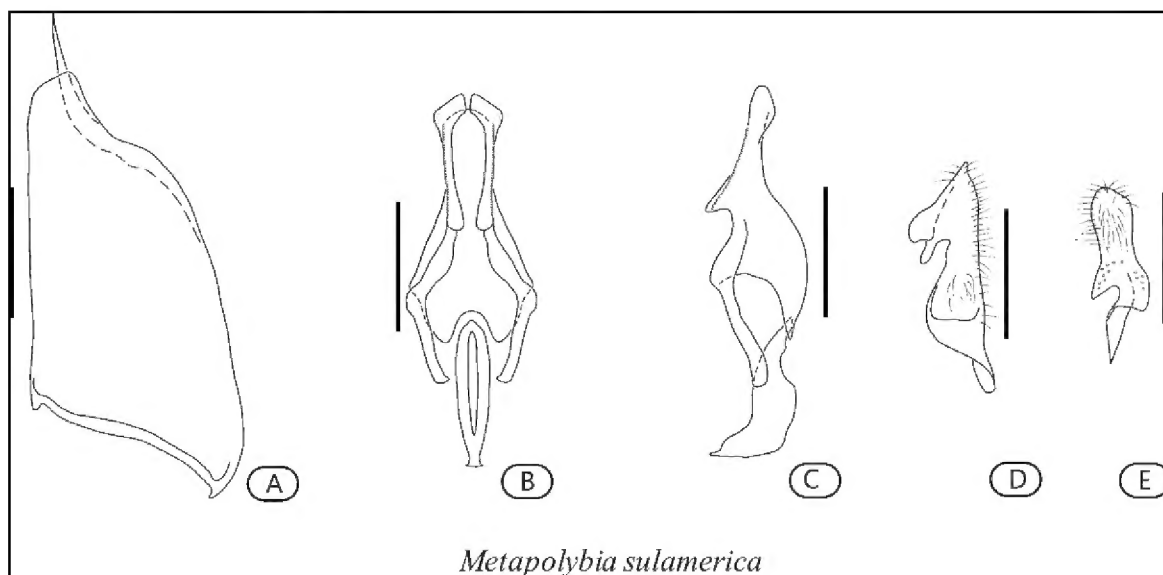


Figure 23. Male genitalia of *Metapolybia sulamerica*. **A** paramere **B** aedeagus, ventral view **C** aedeagus, lateral view **D** cuspis, lateral view **E** digitus, lateral view. Scale bars: 0.5 mm.

(2) aedeagus curved, lobe rounded produced, lateral margin produced; lateral ridge with a row of short teeth extending laterally; ventral process produced, rounded (Fig. 23B, C); (3) cuspis long and pointed and slightly curved, with short and dense hairs apically, extending laterally (Fig. 23D); (4) digitus short apically, blunt, with short and dense hairs, mesal surface with scattered small punctures (Fig. 23E).

Material examined. COLOMBIA • paratype male; Boyacá, Muzo; AMNH.

Comparative remarks

Araujo (1945) published a revision of the genus, which, at that time, had only five species, two being described by him. In the revision of Richards (1978), four new species were described (*M. rufata*, *M. aztecoides*, *M. nigra* and *M. docilis*). Richards (1978) recognized the importance of Araujo's revision, but pointed out that the key proposed by Araujo was not very easy to use. He suggested that striation on propodeum, used to separate *M. cingulata* and *M. unilineata*, was less developed than what was described by Araujo (1945). We have seen some variation not only in this feature cited by Richards (1978) but also the punctation, mainly in frons and vertex, which may cause some mistakes during the identification of the species.

The species here described were deposited in the American Museum of Natural History, and were unidentified or misidentified, certainly due to variation. *Metapolybia carpenteriana* was identified as *M. suffusa*, however, as showed above, it has minor differences that place it as a new species. This is the same as the case of *M. miltoni*, which had been misidentified as *M. docilis* and *M. araujoii*, which is very similar to *M. suffusa*. *Metapolybia pseudodocilis* is close to *M. docilis*, however the striation is stronger, a feature cited by Richards that should be better studied. Besides striation the propodeal concavity is broader, a key feature to separate it from *M. docilis*. *Metapolybia sulamerica* is closer to *M. servilis*—three features may help in diagnosis: the pronotal carina less raised and sharp, clypeus wider and propodeal concavity deeper. *Metapolybia zucchini* is the only new species described that is unique by having an aberrant propodeum that is a very useful diagnostic feature to the species.

In the recent publications about *Metapolybia* (Cooper 1999; Andena and Carpenter (2011); Somavilla and Andena 2018; Andena et al. 2019), as well the revisions of Araujo (1945) and Richards (1978), the characters of the male genitalia did not have special merit. Some authors described the male for some species, but they did not mention the male genitalia, probably because males are seldom collected in nests, and they could have intended to preserve the exemplars.

Concerning male genitalia, the paramere is about 1.8 times longer than wide in *M. bromelicola* and *M. sulamerica*. In the remaining species it ranges from 1.4–1.6 times. The hairs on spine of paramere are absent in *Metapolybia* species. As pointed out by Andena et al (2007) and Andena and Carpenter (2012), the hairs are present only for *Apoica*, *Pseudopolybia* and *Parachartergus*; hence "hair absent" is general for Epiponini. The apical angle of the paramere is truncate in all species described here, except *M. servilis*, where it is

pointed. *Metapolybia sulamerica* has an apical angle less truncate, little angled, but, here, we considered it also as truncate. In general, the aedeagus is curved (slightly less curved in *M. bromelicola*), with the lobe rounded, however in *M. bromelicola* it is very weak, while in *Metapolybia servilis* and *M. mesoamerica* the lobe is more produced; the remaining species are in between. The ventral process of aedeagus is always produced, however it may separate two forms: 1) long—in *M. bromelicola*, *M. carpenteriana*, *M. encantata* and *M. rufata* vs. 2) rounded—found in *M. mesoamerica*, *M. servilis* and *M. sulamerica*. The cuspis is long and pointed, except *M. encantata*, in which it is rounded. The species of form 1 also share the digitus long apically and rounded, except for *M. carpenteriana* that has the digitus short apically and blunt like those of form 2.

In conclusion, the description of new species, including new information about male genitalia increases the knowledge of the genus and highlights how the diversity of this tribe is still underestimated.

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References

- Andena SR, Carpenter JM (2011) A new species of *Metapolybia* (Hymenoptera: Vespidae; Polistinae, Epiponini). *Entomologica Americana* 117 (3/4): 117–120. <https://doi.org/10.1664/11-RA-003.1>
- Andena SR, Carpenter JM (2012) A phylogenetic analysis of the social wasp genus *Brachygastra* Perty, 1833, and description of a new species (Hymenoptera: Vespidae: Epiponini). *American Museum Novitates* 3753: 1–38. <https://doi.org/10.1206/3753.2>
- Andena SR, Mateus S, Nascimento FS, Carpenter JM (2019) Description of a new species of *Metapolybia*, a Neotropical genus of social wasps, from the Amazon Forest. *Sociobiology* 66(2): 377–380. <https://doi.org/10.13102/sociobiology.v66i2.3731>
- Andena SR, Noll FB, Carpenter JM, Zucchi R (2007) Phylogenetic analysis of the neotropical *Pseudopolybia* de Saussure, 1863, with description of the male genitalia of *Pseudopolybia vespiceps* (Hymenoptera: Vespidae, Epiponini). *American Museum Novitates* 3586: 1–11. [https://doi.org/10.1206/0003-0082\(2007\)3586\[1:PAOTNP\]2.0.CO;2](https://doi.org/10.1206/0003-0082(2007)3586[1:PAOTNP]2.0.CO;2)
- Baio MV, Noll FB, Zucchi R (2003) Shape differences rather than size differences between castes in the Neotropical swarm-founding wasp *Metapolybia docilis* (Hymenoptera, Vespidae, Epiponini). *BMC Evolutionary Biology* 3: 10. <https://doi.org/10.1186/1471-2148-3-10>

- Barbosa BC, Detoni M, Maciel TT, Prezoto F (2016) Studies of social wasp diversity in Brazil: Over 30 years of research, advancements and priorities. *Sociobiology* 63: 858–880. <https://doi.org/10.13102/sociobiology.v63i3.1031>
- Carpenter JM, Ross KG (1984) Colony composition in four species of Polistinae from Suriname, with a description of the larva of *Brachygastra scutellaris* (Hymenoptera, Vespidae). *Psiche* 91: 111–140. <https://doi.org/10.1155/1984/73705>
- Chavarría L, Noll FB (2013) Age polyethism in the swarm-founding wasp *Metapolybia miltoni* (Andena & Carpenter) (Hymenoptera: Vespidae; Polistinae, Epiponini). *Sociobiology* 60: 214–216. <https://doi.org/10.13102/sociobiology.v60i2.214-216>
- Chavarría-Pizarro L, da Silva M, Ament DC, Almeida EAB, Noll FB (2023) Behavioural evolution of Neotropical social wasps (Vespidae: Polistinae): the queen selection process. *Cladistics: the international journal of the Willi Hennig Society* 39: 215–228. <https://doi.org/10.1111/cla.12529>
- Cooper M (1999) New species of *Metapolybia* Ducke (Hym., Vespidae, Polistinae). *Entomologist's Monthly Magazine* 135: 107–110.
- Ducke A (1904) Sobre as Vespidas sociaes do Pará. *Boletim do Museu Goeldi* 4: 317–374. <https://doi.org/10.5962/bhl.title.100023>
- Karsai I, Wenzel JW (2000) Organization and regulation of nest construction behavior in *Metapolybia* wasps. *Journal of Insect Behavior* 13: 111–140. <https://doi.org/10.1023/A:1007771727503>
- Richards OW (1978) The social wasps of the Americas excluding the Vespinae. British Museum (Natural History), London, 580 pp.
- Smethurst ME, Carpenter JM (1998) A new species of *Metapolybia* Ducke from Central America (Hymenoptera: Vespidae; Polistinae). *Journal of the New York Entomological Society* 105: 180–185.
- Somavilla A, Andena SR (2018) *Metapolybia araujoi*, a new species of swarming social wasp from the Brazilian Amazon rainforest (Vespidae: Polistinae). *Revista Brasileira de Entomologia* 62: 83–86. <https://doi.org/10.1016/j.rbe.2018.02.001>
- Somavilla A, Oliveira ML, Andena SR, Carpenter JM (2018) An illustrated atlas for male genitalia of the New World *Polistes* Latreille, 1802 (Vespidae: Polistinae). *Zootaxa*. 4504(3): 301–344. <https://doi.org/10.11646/zootaxa.4504.3.1>
- Wenzel JW (1998) A generic key to the nests of hornets, yellow jackets, and paper wasps worldwide (Vespidae: Vespinae, Polistinae). *American Museum Novitates* 3224: 1–39.
- West-Eberhard MJ (1978) Temporary queens in *Metapolybia* wasps: non-reproductive helpers without altruism? *Science* 200: 441–443. <https://doi.org/10.1126/science.200.4340.441>
- West-Eberhard MJ (2000) Intragroup selection and evolution of insect societies. In: Alexander RD, Tinkle DW (Orgs.) *Natural selection and social behavior*. Chiron Press, New York, 3–17.